

A HUMPBACK WHALE CALF AND TWO SUBADULT DENSE-BEAKED WHALES RECENTLY STRANDED IN SOUTHERN QUEENSLAND

R.A. PATERSON, C.J. QUAYLE AND S.M. VAN DYCK

Paterson, R.A., Quayle, C.J. & Van Dyck, S.M. 1993 06 30: A Humpback Whale calf and two subadult Dense-beaked Whales recently stranded in southern Queensland. *Memoirs of the Queensland Museum* 33(1): 291-297. Brisbane. ISSN 0079-8835.

A new born Humpback Whale calf (*Megaptera novaeangliae*) and two subadult Dense-beaked Whales (*Mesoplodon densirostris*) recently stranded on the southern Queensland coast. The *M. densirostris* skeletons were recovered together with various soft tissue material. The post-cranial skeleton of the *M. novaeangliae* was not recovered. The larynges of the three specimens were examined in detail. □ Humpback Whale, Dense-beaked Whale, stranding, Queensland.

R.A. Paterson & S.M. Van Dyck, Queensland Museum, PO Box 3300, South Brisbane, Queensland 4101, Australia; C.J. Quayle, Brisbane Clinic, 79 Wickham Terrace, Brisbane, Queensland 4000, Australia; 2 December, 1992.

Opportunities to examine stranded balaenopterid and ziphiid whales, with the exception of Minke Whales (*Balaenoptera acutorostrata*), on the Queensland coast are limited (Paterson & Van Dyck, 1990, 1991). Recently, material recovered from a new born Humpback Whale *Megaptera novaeangliae* and two subadult Dense-beaked Whales *Mesoplodon densirostris* was a valuable addition to the cetacean collection in the Queensland Museum. The *M. novaeangliae* specimen is registered JM8658 and the *M. densirostris* specimens are registered JM8807 and JM9640.

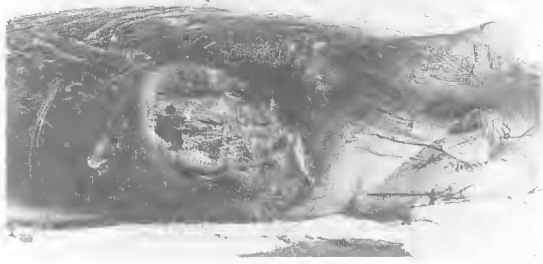


FIG. 1. Shark bites on left side of *Megaptera novaeangliae* JM8658. The anterior bite extended deeply into the thoracic muscles.

SPECIMEN DESCRIPTIONS

HUMPBACK WHALE

JM8658 was a 4.7m long new born (umbilicus unhealed) female that stranded alive during the afternoon of 19 July, 1991 at Eager's Creek (27°07'S, 153°27'E) on the oceanic shore of Moreton Island. Two large non-bleeding shark bites were noted on the left side of the body as



FIG. 2. Extensive superficial rakes on *Megaptera novaeangliae* JM8658. They are considered to be caused by sharks.

well as numerous superficial rakes (Figs 1,2). The whale was refloated and pushed into the surf but was found dead at the same location a few hours later. We examined the carcass three days later. The larger of the previously noted bites extended deeply into the thoracic muscles and its edges showed signs of early healing indicating that the shark attack was not an immediate pre-stranding event.

Material collected included the skull and mandible, blubber and skin samples (the latter for



FIG. 3. Recent and healed 'cookie-cutter' lesions on *Mesoplodon densirostris* JM8807.



FIG. 4. Close-up view of 'cookie-cutter' lesions on *Mesoplodon densirostris* JM8807. The throat groove characteristic of ziphiids is also demonstrated.



DNA study) and the larynx. The mid-dorsal blubber thickness was 2.8cm and is consistent with recent birth. Comparative blubber thicknesses from a *M. novaeangliae* calf, approximately four weeks old, and a yearling in the Queensland Museum collection are 4.5cm and 9.7cm respectively. The right baleen row numbered 340 ± 5 , consistent with the range for the species (Matthews, 1937). The largest baleen plates measured 8.5cm in length.

The stranding of a new born *M. novaeangliae* at latitude 27°S in July confirms previous sighting reports (Chittleborough, 1965; Paterson & Paterson, 1984, 1989) that occasional calving occurs during the northern migration of the species along the Australian coast at latitudes higher than those



FIG. 5. Left, *Mesoplodon densirostris* JM8807. Radiograph of left pectoral flipper demonstrating distal aspects of radius and ulna, carpus, metacarpals and phalanges. Skeletal immaturity is evident. The ossification centre for the peripheral unciform has not yet appeared. Right, *Mesoplodon densirostris* JM9640. Radiograph of left pectoral flipper showing eight carpal bones compared with seven in JM8807. (The triangular structure overlying the distal ulna is frozen soft tissue from the axillary region.)

at which calving is generally considered to occur (Chittleborough, 1953; Simmons & Marsh, 1986; Townsend, 1935).

DENSE-BEAKED WHALES

JM8807 was a 3.8m long female found dead at dawn on 22 October, 1991 at Main Beach, Point Lookout (27°26'S, 153°33'E) on North Stradbroke Island. Recent and healed superficial 'cookie-cutter' lesions were noted and they coalesced ventrally (Figs 3,4). They were similar to, but not as extensive as, those noted in a mature

male *M. densirostris* described by Paterson & Van Dyck (1990). The whale was dark grey dorsally and lighter grey ventrolaterally, particularly in the umbilical and genital regions and around the V-shaped throat groove characteristic of ziphiids.

We examined the carcass the day after its discovery. The entire skeleton was collected. The vertebral formula C7; T9; L10; Cd18=44 is less than counts of 46 and 47 in two *M. densirostris* from the Atlantic coast of North America and 45 in a specimen from Lord Howe Island (Raven,

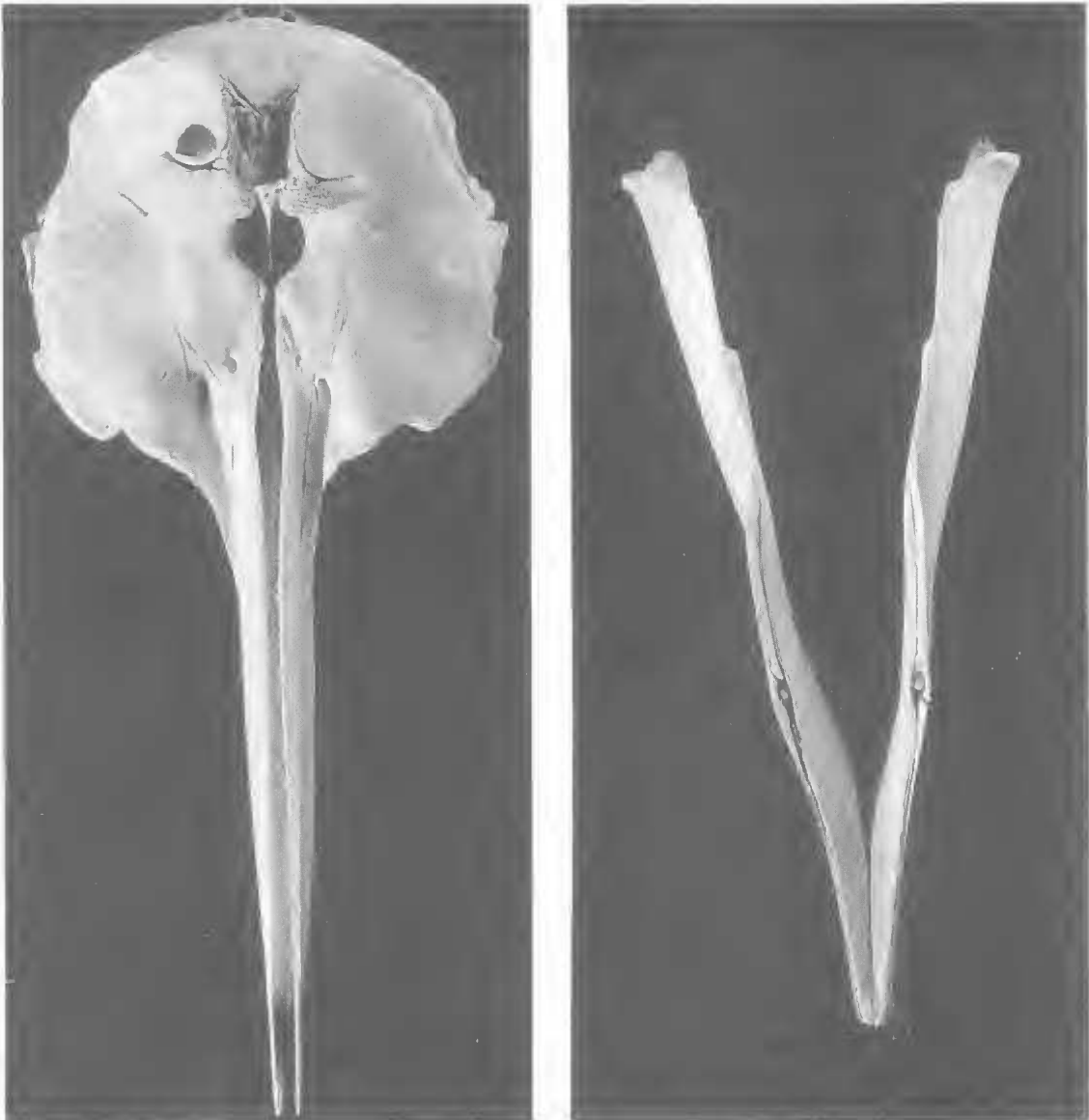


FIG. 6. *Mesoplodon densirostris* JM8807: left, dorsal aspect of skull; right, dorsal aspect of mandible.



FIG. 7. *Mesoplodon densirostris* JM8807. Left lateral mandibular radiograph demonstrating unerupted tooth characteristic of females.

1942) but is within the range described by Ross (1984). The size discrepancy between the penultimate and last caudals suggests the possibility that one caudal was lost during preparation. With the exception of the coalesced proximal three cervical vertebrae, the central epiphyses of all vertebrae were unfused. The phalangeal formula, derived from a radiograph of the left pectoral flipper (Fig. 5), is I:1, II:4, III:4, IV:3, V:2, which differs slightly from that reported by Kasuya & Nishiwaki (1971) in a Formosan specimen of *M. densirostris*. They (p.133 & fig.1) appear to have included the metacarpals in the formula. The skull and mandible are shown in Fig. 6. The characteristically shaped unerupted mandibular tooth of female *M. densirostris* is demonstrated radiographically in Fig. 7. The tooth measured 52mm in height, 30mm in length and 9mm in greatest diameter. Its pulp cavity was completely unfilled.

Moderate nematode (*Anisakis* sp.) and acanthocephalan (*Bolbosoma vasculosum*) infestation was noted in the stomach and intestine respectively. The gastro-intestinal tract was otherwise empty.

One ovary was collected. Its external features

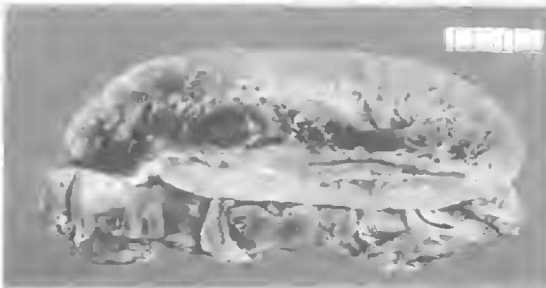


FIG. 8. *Mesoplodon densirostris* JM8807. External ovarian features. Scale in mm.

are shown in Fig. 8. Histological examination was reported as follows:

The ovary contains numerous primordial follicles, a few secondary follicles, occasional cystic atretic follicles and some small hyaline scars which may represent corpora albicans. No corpora lutea can be identified.

The presence of secondary follicles indicates sexual maturity is, at least, approached. It is uncertain whether ovulation has occurred. If the small scars are true corpora albicans this would indicate that ovulation had taken place but the evidence is insufficient to establish this with certainty.

Although the ovarian histological evidence indicates that this 3.8m long animal was approaching sexual maturity, the lack of epiphyseal fusion indicates physical immaturity. The dental, sexual and physical development of JM8807 was similar to that of the 3.56m long Formosan specimen described by Kasuya & Nishiwaki (1971).

JM9640 was a 3.65m long female found dead during the morning of 21 June, 1992 at Cathedral



FIG. 9. 'Cookie-cutter' lesions and characteristic throat groove of ziphiids on *Mesoplodon densirostris* JM9640.

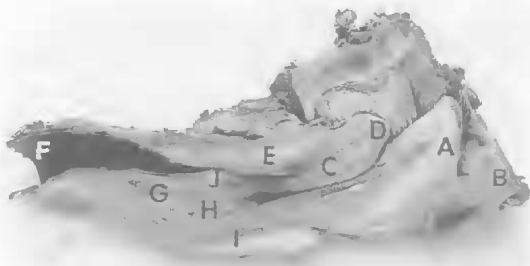


FIG. 10. Larynx *Megaptera novaeangliae* JM8658 in longitudinal section, medial aspect, with thyroid cartilage removed: (A) epiglottic cartilage; (B) fibrous attachment to thyroid cartilage; (C) arytenoid cartilage-corpus; (D) arytenoid cartilage-rostral end; (E) cricoid cartilage; (F) tracheal lumen; (G) fundus of ventral diverticulum; (H) neck of the ventral diverticulum; (I) thyroarytenoid muscle; (J) interarytenoid fibro elastic connection.

Beach (25°10'S, 153°13'E) on Fraser Island. 'Cookie-cutter' lesions of similar distribution to those on JM8807 were evident as well as the characteristic throat groove (Fig. 9).

We were unable to visit the stranding site to examine the whale but arranged for its head and a pectoral flipper to be removed and frozen so that they could be subsequently studied in a fresh state. The remainder of the carcass was buried in sand dunes behind the beach and the skeleton was retrieved two months later. The vertebral epiphyseal status and vertebral formula (C7; T9; L10; Cd18 = 44) were identical to JM8807 but the last caudal may have been lost. Unfortunately numerous rib and vertebral fractures had occurred during transportation of the carcass to the sand dunes and those fractures detract from the specimen's quality.

The phalangeal formula 1:1, II:4, III:4, IV:3, V:2 is identical to JM8807. The carpus contains

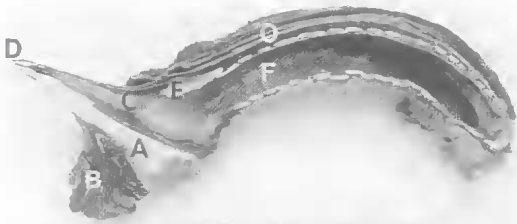


FIG. 11. Larynx *Mesoplodon densirostris* JM8807 in longitudinal section, medial aspect, with thyroid cartilage removed. (A) epiglottic cartilage; (B) fibrous attachment to thyroid cartilage; (C) arytenoid cartilage-corpus; (D) arytenoid cartilage-rostral end; (E) cricoid cartilage; (F) tracheal lumen; (O) oesophagus.

eight bones (Fig. 5) compared with seven in JM8807 and the Formosan specimen. Raven (1942) demonstrated eight carpal bones in an adult male *M. densirostris*. We presume that the ossification centre of the peripheral unciform had not yet developed in either JM8807 or the Formosan specimen but are surprised at the apparent late development of this bone which is larger than its neighbours in both JM9640 and the specimen illustrated by Raven (1942).

The left tooth measured 54mm in height, 47mm in length and 10mm in greatest diameter. Its pulp cavity was extensively obliterated. On the basis of the dental and carpal development we conclude that JM9640 was more mature than JM8807.

LARYNGEAL STRUCTURE

Various authors, including Benham (1901) and Hosokawa (1950), have compared the larynges of mysticetes and odontocetes. The former are characterised by a large ventral diverticulum surrounded by the thyro-arytenoid muscle and the latter by the aryteno-epiglottideal tube, an upward extension of the fused arytenoid and epiglottic cartilages into the choana. Those features have been demonstrated in JM8658, JM8807 and JM9640.



FIG. 12. Larynx and oesophagus *Mesoplodon densirostris* JM8807 from dorsal aspect. The bossed tip of the aryteno-epiglottideal tube is shown on the right. (C) arytenoid cartilage-corpus; (D) arytenoid cartilage-rostral end; (F) trachea; (O) oesophagus.

The larynx of JM8658 is shown in longitudinal section in Fig. 10 and the salient anatomical structures have been annotated in conformity with the description by Quayle (1991) of the larynx of a male *M. novaeangliae* of similar development to JM8658. There is no appreciable difference between those male and female specimens.

Quayle (1991) considered that phonation could occur between the apposing arytenoids in mysticetes although true vocal cords were not evident. He also proposed a functional role for the ventral diverticulum in the production of the complex sounds of *M. novaeangliae*. Mysticetes presumably generate high pressures within the oral cav-

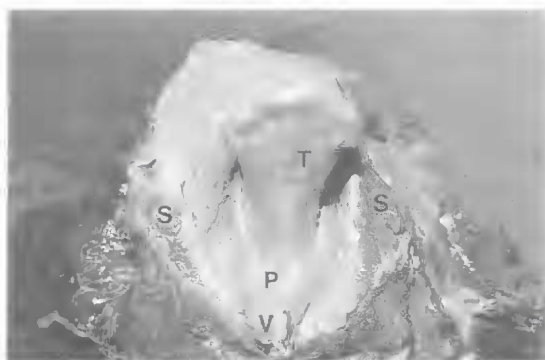


FIG. 13. Laryngo-pharynx *Mesoplodon densirostris* JM9640 from rostral aspect. (P) palato-pharyngeus; (S) superior constrictor of pharynx; (T) aryteno-epiglottideal tube; (V) vomerine attachment of palato-pharyngeus.

ity and pharynx during feeding when large volumes of water are forced through the baleen. The ventral diverticulum may have an additional function in assisting to prevent water from entering the trachea.

The larynx of JM8807 is shown in longitudinal section (Fig. 11) as well as from its dorsal aspect (Fig. 12). The aryteno-epiglottideal tube is bossed at its tip and was closely applied to the posterior narial canal. The almost complete fusion of the arytenoid and epiglottic cartilages and their relationship to the posterior nares more effectively separates the aero-digestive tracts in this odontocete compared with JM8658.

The fresh laryngo-pharynx of JM9640 is shown in Figs 13,14,15. In Fig. 13 the aryteno-epiglottideal tube is demonstrated from the rostral aspect and a large muscular cuff (the superior constrictor of the pharynx) is noted peripherally. The margin of this muscle has been dissected from the bony posterior choana. A circular muscle, whose mar-

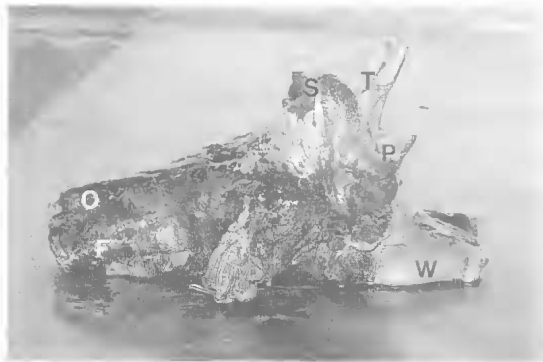


FIG. 14. Laryngo-pharynx *Mesoplodon densirostris* JM9640 from lateral aspect. (F) trachea; (O) oesophagus; (P) palato-pharyngeus; (S) superior constrictor; (T) aryteno-epiglottideal tube; (W) oro-pharynx.

gin was partially separated from the superior constrictor appeared to 'grip' the aryteno-epiglottideal tube. This circular muscle is the palato-pharyngeus (Hosokawa, 1950) and it had an anterior attachment to the vomer. The disposition of the superior constrictor and the palato-pharyngeus to the aryteno-epiglottideal tube in the lateral position is demonstrated in Fig. 14. We postulate that the superior constrictor in combination with the palato-pharyngeus may act inter alia to expel water from the choanal region. In Fig. 15 the laryngo-pharynx is shown in wider perspective and the palato-pharyngeus has been partially retracted. A large probe has been passed through the oro-pharynx. It traverses the pyriform fossa (which is beside the larynx) and enters the oesophagus. This further demonstrates the separation of the aero-digestive tracts in this odontocete.

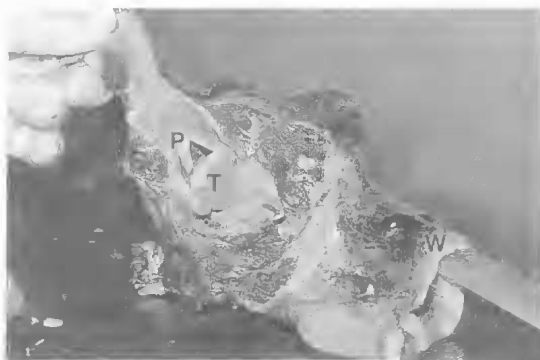


FIG. 15. Laryngo-pharynx *Mesoplodon densirostris* JM9640 from dorso-rostral aspect. The large probe is seen in the oro-pharynx. It was passed through the left pyriform fossa to enter the oesophagus which is obscured by the retracted superior constrictor and palato-pharyngeus. (P) palato-pharyngeus; (S) superior constrictor; (T) aryteno-epiglottideal tube; (W) oro-pharynx.

In this fresh specimen it was not possible to retract the aryteno-epiglottideal tube. Pilleri (1979) considered, on the basis of acoustic experiments, that the aryteno-epiglottideal tube was retracted during deglutition and disagreed with Rawitz (1900) who stated that food passed to the side of the larynx. Our opinion, based on morphological considerations, concurs with that of Rawitz.

ACKNOWLEDGEMENTS

We are indebted to many people who assisted with retrieval and preparation of the specimens. Alan Gennings of the Moreton Island Protection

Committee photographed JM8658 and Reg Lambert photographed JM8807. Brendan McLarty of QNPWS secured JM8658 and transported us to the stranding site. Lis Sedlak-Weinstein of the University of Queensland examined JM8807 for parasites and assisted with retrieval of the specimen. John Ford of QNPWS photographed JM9640 and secured the specimen. Paul Stumkat of the Queensland Museum retrieved its skeleton. John Musgrave of Sullivan, Nicolaides and Partners arranged the histological examination of JM8807 and Stephen Marmo of the X-ray Department, Royal Brisbane Hospital took the radiographs. Bruce and Carolyn Cowell patiently and skilfully photographed and prepared material at the Queensland Museum and Jeff Wright took some of the laryngeal photographs.

LITERATURE CITED

- BENHAM, W.B. 1901. On the larynx of certain whales (*Cogia*, *Balaenoptera* and *Ziphius*). Proceedings of the Zoological Society of London 1: 278-300.
- CHITTLEBOROUGH, R.G. 1953. Aerial observations on the humpback whale *Megaptera nodosa* (Bonnaterre), with notes on other species. Australian Journal of Marine and Freshwater Research 4: 219-226.
1965. Dynamics of two populations of the humpback whale, *Megaptera novaeangliae* (Borowski). Australian Journal of Marine and Freshwater Research 16: 33-128.
- HOSOKAWA, H. 1950. On the cetacean larynx, with special remarks on the laryngeal sack of the sei whale and the aryteno-epiglottideal tube of the sperm whale. Scientific Reports of the Whales Research Institute, Tokyo 3: 23-62.
- KASUYA, K. & NISHIWAKI, M. 1971. First record of *Mesoplodon densirostris* from Formosa. Scientific Reports of the Whales Research Institute, Tokyo 23: 129-137.
- MATTHEWS, L.H. 1937. The humpback whale *Megaptera nodosa*. Discovery Reports Cambridge 17: 7-92.
- PATERSON, R. & PATERSON, P. 1984. A study of the past and present status of humpback whales in east Australian waters. Biological Conservation 29: 321-343.
1989. The status of the recovering stock of humpback whales *Megaptera novaeangliae* in east Australian waters. Biological Conservation 47: 33-48.
- PATERSON, R.A. & VAN DYCK, S. 1990. Records of beaked whales in Queensland. Scientific Reports of Cetacean Research 1: 63-77.
1991. Studies of two humpback whales, *Megaptera novaeangliae*, stranded at Fraser Island, Queensland. Memoirs of the Queensland Museum 30(2): 343-350.
- PILLERI, G. 1979. Sonar field patterns in cetaceans, feeding behaviour and the functional significance of the pteryoschisis. Investigations on Cetacea 10: 147-156. (Pilleri, G., ed., Brain Anatomy Institute, Berne).
- QUAYLE, C.J. 1991. A dissection of the larynx of a humpback whale calf with a review of its functional morphology. Memoirs of the Queensland Museum 30(2): 351-354.
- RAVEN, H.C. 1942. On the structure of *Mesoplodon densirostris*, a rare beaked whale. Bulletin of the American Museum of Natural History 80: 23-50.
- RAWITZ, B. 1900. Die Anatomie des Kehlkopfes und der Nase von *Phocaena communis*, Cuv. Internationale Monatschrift für Anatomie und Physiologie 17: 245-354.
- ROSS, G.J.B. 1984. The smaller cetaceans of the south east coast of southern Africa. Annals of the Cape Provincial Museums (Natural History) 15(2): 173-410.
- SIMMONS, M.L. & MARSH, H. 1986. Sightings of humpback whales in Great Barrier Reef waters. Scientific Reports of the Whales Research Institute, Tokyo 37: 31-46.
- TOWNSEND, C.H. 1935. The distribution of certain whales as shown by logbook records of American whaleships. Zoologica 19: 1-50.